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Title: Expected Short Sample Performances of SSC-P-11

Task Force: Coil Geometry Analysis

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The central and peak fields of coil design P11, which consists of 2 layers of standard CBA cable run with out current 1.35 times inner, are given in Table 1 at two inner currents as computed using program MDP with iron model DBL15B.

Table 1.

Iin	Bo	Bpk,in	Bpk,out	$I_{c,in}$	I_{c}out
3500	50983	54505	43974	4472	5731
4500	63954	68362	54981	2997	4401

The peak field points are located about 15% of the distance from the upper inner corner to the upper outer corner of the turn nearest the pole. The critical currents are based on measured values as follows:

5T, 5584A, 5.5T, 4972 A (4.22 K, field perpendicular).

The critical currents of Table 1 assume boiling helium at 19 psia, 4.504K. The correlation used is:

$$I_c = P_1 \left(1 - \frac{T-4.2}{P_2+P_3B}\right) \left(\frac{1 + P_4B}{1 + P_5B+P_6B^2}\right) \qquad (1)$$

where $P_2 = 4.996$, $P_3 = -0.465$, $P_4 = -.10263$, $P_5 = .31525$ and $P_6 = -.030335$, T is temperature (K) and B is field in tesla; this correlation is based on data from several sources. P_1 from the two measured critical currents is 21008 and 20905, the average 20957 was used for the I_c of Table 1. For interpolation in Table 1 the load line (transfer function) is assumed to vary linearly with B.

This gives for an interpolation expression

$$B = T_f I/(1 + aI) \qquad (2)$$

The values of a and T_f fitting the 3 field points of Table 1 are given in Table 2.

Table 2.

	Bo	Bpk,in	Bpk,out
T	15.961	17.074	10.330
a	2.735-5	2.753-5	2.327-5

By iterative interpolation, the field values given in Table 3 are obtained

Table 3.

Iin	Iout	Bo	Bpk,in	Bpk,out	$I_c$in	I_c,out
3860	5211	55726	59573	48008	3903	5215

Thus the inner layer has 1% more margin than the outer.

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